

Naval Medical Research and Development Command 1997 Command History



8901 Wisconsin Avenue
Building 1, T-11
Bethesda, MD 20889-5606



NAVAL MEDICAL RESEARCH AND DEVELOPMENT COMMAND

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Naval Medical Research and Development Command

Mission

- Our mission is to provide timely solutions to Navy and Marine Corps medical and operational problems through biomedical research, development, test, and evaluation.

Vision

- We will be an unparalleled provider of biomedical research products and services to the Navy.
- We will be recognized by senior Navy leadership and the operational forces as a vital and integral Navy asset during peace and war.
- We will maintain a world-class scientific program and will be regarded by national and international biomedical research communities as a vital international resource setting the standard for excellence in biomedical research.
- We will each be empowered members of our multi-disciplinary biomedical research team and will continually strive to enhance our value to the Navy and our contributions to the health care of our Nation.

Guiding Principles

- We will view people as our most valuable resource.
- We will keep our programs focused on current and anticipated Navy and Marine Corps needs.
- We will communicate proactively with our customers on requirements, planning, and execution and will solicit their feedback on all aspects of our service.
- We will foster vigorous staff participation in identifying, advocating, planning, and executing our programs.
- We will encourage collaboration with other Department of Defense organizations, government laboratories, universities, and industry.
- We will continually develop and use new technologies in our programs and will take every opportunity for technology transfer and dual-use.
- We will nurture a creative research and development environment that encourages the free exchange of ideas, the highest ethical values, and the professional growth of our people.
- We will establish a climate of trust and teamwork.
- We will be committed to strong, competent scientific management and leadership.
- We will continuously improve all aspects of our enterprise.

Commanding Officer

CAPT Timothy J. Singer, MSC, USN Commanding Officer

CAPT Timothy J. Singer, MSC, USN assumed command of the Naval Medical Research and Development Command on the retirement of CAPT Thomas N. Jones, MSC, USN on 1 Sept. 97.

CAPT Singer began his military career as an Army enlisted man serving in infantry units of the 2nd and 7th Infantry Divisions. He graduated Phi Beta Kappa with a Bachelor of Arts degree in Physiological Psychology from Reed College in Portland, Oregon in 1973. As a National Institutes of Health Fellowship recipient, he completed his graduate studies at Yale University, New Haven, Connecticut in 1976, earning an M.S., and Ph.D. in clinical psychology.



From 1976 to 1980, CAPT Singer served as a Biomedical Science Corps officer (Captain) in the USAF. He completed his Clinical Psychology residency at Wilford Hall USAF Medical Center, San Antonio, Texas. Following reassignment, he served with the Strategic Air Command (SAC) at the Base Hospital, Loring AFB, Limestone, Maine. In the latter capacity, CAPT Singer served not only as Department Head, Mental Health Services, but also as a consultant to the Office of Special Investigation and as a medical department representative to SAC's Wartime Contingency Planning group.

Following an inter-service transfer, CAPT Singer received his commission as a Naval officer in November 1980 and, after six months of training at the School of Aviation Medicine, Naval Aerospace Medical Institute, Pensacola, Florida, was designated as a Naval Aerospace Experimental Psychologist. With immediate follow-on training at the Aviation Safety Officer program, Naval Postgraduate School, Monterey, California, CAPT Singer went on to serve as an Aeromedical Safety Officer (AMSO) and member of a three-person Aviation Mishap Investigation Team for COMNAVAIRPAC, NAS North Island, San Diego, California (1981-1983). Highlights of that period included participation in the investigation of 40 aircraft mishaps, part-time duty as an instructor in the IDT course at Balboa, and collateral service as a military coordinator for the San Diego County Disaster Preparedness Team.

From 1983 to 1989, CAPT Singer served at the Naval Air Development Center, Warminster, Pennsylvania: first, as a Project Engineer (1983-84), later as the Block Program Manager for Human Factors Engineering (1984-87), and finally, as the Superintendent, Human Factors and Protective Systems Division. With an annual operating budget of \$20 million, and a staff of over 100 scientists and engineers, his division won several national awards while conducting research and development efforts in the areas of human factors, control and display technology, acceleration and thermal physiology, personal protective clothing and devices, biomechanics, and medical support services for human subjects under stress.

In 1989, CAPT Singer reported to the Crew Systems Division, Naval Air Systems Command, Washington, DC, as the Special Systems Program Manager, which included responsibility for the direction of the Engineering Development (6.4) Phase of the Advanced Technology Crew Station (ATCS) program. A \$30 million program, ATCS involved the efforts of two major aerospace companies and the coordinated activities of scientists and engineers at several Naval research and development centers. From 1991 to summer 1994, CAPT Singer was assigned to the Naval Medical Research and Development Command (NMRDC), Bethesda, Maryland, as the Research Area Manager for Aviation Medicine and Human Performance. During this period he organized and directed major medical research programs in support of USN/USMC aviation, Fleet and

Naval Special Warfare Operations. From 1994 to 1995, CAPT Singer served as Director, External Relations, NMRDC, directing the Command's technology transfer, public affairs, and congressional liaison programs. From August of 1995 to September of 1997, CAPT Singer served as the Executive Officer for the same Command. He has also served on numerous Navy and Tri-Service committees, including serving as the Chairman of the Human Systems Technology Joint Coordinating Group (JTCCG-5) of the Armed Services Biomedical Research and Evaluation Management Committee.

CAPT Singer has authored scientific and technical reports, served as a Guest Lecturer at the Naval Academy and received an appointment as an Adjunct Assistant Professor of Health Care Sciences at the George Washington University School of Medicine. He is an Associate Fellow of the Aerospace Medical Association and an active member of several professional associations. Prominent among CAPT Singer's military achievements were his selection as a Navy NASA Mission Specialist Astronaut Nominee (1987-1990) and receipt of a Project Leadership Award. His Military Awards include: the Meritorious Service Medal with Gold Star, the Navy Commendation Medal, the USAF Commendation Medal, the Navy Achievement Medal, the National Service Defense Medal with Bronze Star, and the Armed Forces Expeditionary Service Medal.

CAPT Singer is married to the former Ann R. Widmer of Scotia-Glenville, New York. They have two daughters: Rachael and Lindsay.

NMRDC Commanding Officers

CAPT T.J. Singer, MSC, USN	1997
CAPT T.N. Jones, MSC, USN	1994 - 1997
CAPT E.T. Flynn, MC, USN	1991 - 1994
CAPT J.N. Woody, MC, USN	1988 - 1991
CAPT W.M. Houk, MC, USN	1985 - 1988
CAPT J.F. Kelly, DC, USN	1980 - 1985
CAPT J.D. Bloom, MC, USN	1977 - 1980
CAPT E. Brodine, MC, USN	1974 - 1977

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Key Personnel

Code	Title	Name
00	Commanding Officer	T.J. Singer, CAPT, MSC, USN
09	Executive Officer	vacant
00A	Command Master Chief	A. Agayan, HMCS, USN
01	Director, Resources and Finance	D. S. Alexander, LT, MSC, USN
02	Director, Administration	J.P. Sanderson, LCDR, MSC, USN
04	Director, Research and Development	T.J. Singer, CAPT, MSC, USN

As the year began, numerous re-engineering changes were taking shape within the headquarters and the subordinate laboratories and downsizing and reductions in infrastructure became a reality. To retain the most relevant research efforts it became necessary to implement plans for specific mid- and long-term actions for the disestablishment of the headquarters command. This included realigning the program management functions with the Office of Naval Research and realigning the laboratory system within the Bureau of Medicine and Surgery by 1 Oct. 98. Through these turbulent times, the Naval Medical Research and Development Command (NMRDC) maintained a strong commitment to conducting biomedical research based on DoD requirements to meet the Navy's mission to maintain, train and equip combat-ready Naval forces capable of winning wars, deterring aggression and maintaining freedom of the seas.

NMRDC scientists conduct basic, clinical, and field research directly related to military requirements and operational needs. Current studies focus on military recruits, special training groups, and personnel in the surface, submarine, air, and amphibious warfare communities. NMRDC laboratory facilities equal those at modern academic and industrial institutions. Also, research is supported in other Navy laboratories as well as in partnership with the Army and Air Force and with other Federal agencies. Research in non-government laboratories is promoted through an active collaborative research and technology transfer program that develops cooperative research and development agreements with universities and private industry to ensure that research products from our laboratories benefit the entire country.

Navy-supported medical research efforts have influenced the civilian practice of medicine, assisted the Ministries of Health in developing nations, and provided technology for other Federal initiatives.

NMRDC's research programs are divided into six major areas. A headquarters staff officer is assigned as the Research Area Manager for each program area. The Research Area Managers are the central contact points between the laboratories, where the research takes place, and headquarters, where budget decisions are made and research planning and execution policy is established. The Research Area Managers manage both intramural and extramural research activities. The in-house research efforts are complemented by a contract and grant program with universities and private industry.

NMRDC's six major research areas

Combat Casualty Care

Program Officer for Combat Casualty Care (located at ONR)

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The Combat Casualty Care Program, NMRDC's largest research program, directs research with results that enhance fleet health care, augment field treatment capabilities, and improve the medical logistics necessary to support Navy and Marine Corps personnel. On-going projects focus on developing and incorporating advanced medical capabilities into each echelon of combat medical care. To improve combat casualty care, investigators are developing technologies to enhance recovery from combat-related illnesses and injuries. Scientists are developing techniques for acclimating personnel to extreme environmental temperatures. Advancements are being made in developing universally transfusable human red blood cells and in evaluating the effectiveness of blood substitutes. Improved procedures are being developed for enhancing the recovery of injured hematopoietic and immune systems with the development of therapeutic reagents and with the use of recombinant growth factors and cytokines.

Current efforts focus on:

- Field usable diagnostics
- Hematopoietic stem cells
- Septic shock
- Medical readiness planning tools
- Critical medical information capture, storage and transmission tools
- Blood products
- Immune system recovery
- Hot/cold weather injuries
- Combat medical devices
- Casualty stabilization and resuscitation
- Blood substitutes
- Wound healing
- Hemorrhagic shock
- Musculoskeletal injury
- Patient identification and management aid

Examples of Products Under Development

Recruit Fitness Training Schedule	A fitness program was developed to produce physically fit Marines after 11 weeks of training while reducing the impact of stress fractures. A reduction of stress fractures by 2% in one year will save \$5.2M annually at NCRD San Diego and save 15,000 lost training days. An additional savings of approximately \$1.2M annually will result from the reduction of the overall rate of musculoskeletal injuries from 34% to 24%.
Predictive profile for graduation from BUD/S	An epidemiologic model which links successful graduation from BUD/S to a trainee's fitness is under development. A significant improvement in physical fitness in trainee selected from NTC, Great Lakes can be expected to increase graduation rates by 20% yielding a cost savings of \$750,000 annually in PCS orders and relocation of family members. Once implemented, the program will have no additional costs.

FORECAS	FORECAS is an interactive tool for medical planners designed to project the numbers of ground casualties (WIA, KIA, DNBI) likely to be sustained during various ashore combat scenarios. Accurate predictions of the likely casualties to be incurred helps ensure that sufficient medical and manpower resources are deployed, but are not oversupplied.
SHIPCAS	SHIPCAS is an interactive tool for medical planners designed to project the numbers of shipboard casualties (WIA, KIA, DNBI) likely to be sustained during various afloat combat scenarios. Accurate predictions of the likely casualties to be incurred helps ensure that while sufficient medicine and manpower resources are deployed, they are not oversupplied.
MEDTAG	MEDTAG is a hand-held device for retrieving data stored electronically on an individually carried card and for documenting battlefield injury data, patient conditions information, and treatments rendered. More rapid and accurate documentation of clinical information will lead to more timely care, reduced recovery time, and improved effectiveness.
OPTEVAC	An interactive tool for medical planners designed to project the required evacuation assets to transport casualties from the point of injury to the Echelon II treatment facility and then to an Echelon III facility. OPTEVAC factors in the distances between facilities and deployment nodes and provides the planner with the number and types of air/ground ambulances needed. Accurate predictions of the required evacuation assets help ensure that while sufficient transport vehicles to handle the casualty evacuation demands of an operation are deployed, they are not oversupplied.
Special Operations Interactive Medical Training Program	SOIMPT was developed to assess the feasibility of using a computer-based system to provide medical training for corpsmen and medics attached to Special Operations units of the Army, Navy, Marine Corps, and Air Force. SOMTP is a modular medical training system that runs on a personal computer. The present version of SOIMPT has training modules in 21 different subject areas. Each of the individual modules was developed to provide training in specific areas that are relevant to SpecOps forces and the unique environments in which they must operate.
OSHSYS	An interactive tool for naval operations and facility safety managers to identify the costs of occupational injuries, to compare their local facility injury rates with other facilities, and to assess the effectiveness and economic value of prevention and cost control programs. Accurate predictions will facilitate safety program planning and increase accountability at the local level.
Frozen Blood	By drawing, freezing, storing and distributing frozen units of blood, the logistics burden is lessened considerably. Provision of blood and blood products where and when needed.

Infectious Disease

Research Area Manager, Infectious Diseases

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With Sailors and Marines deployed around the world, mission-specific medical research on infectious diseases continues to be one of the Navy's highest priorities. Deployed personnel can be exposed to endemic diseases, many of which are rarely, if ever, encountered by physicians in the United States. For this reason, the Navy has developed a series of strategically located overseas laboratories to study disease threats. These laboratories conduct basic, clinical, and field research related to the health and operational readiness of Sailors and Marines deployed to specific areas overseas. Each laboratory is capable of deploying highly trained personnel and state-of-the-art laboratory diagnostic capabilities to any remote location. These laboratories, teamed with strong basic-science and technology-based laboratories in the United States, develop methods to prevent, diagnose, and treat the many tropical diseases encountered during military operations. The results of this continuous research has been key to the success of many military missions.

Current efforts focus on:

- Methods for rapid identification and diagnosis of microorganisms that cause disease
- Epidemiologic assessment of emerging infectious diseases
- Development of field test sites for vaccines, drugs, and equipment
- Development of vaccines and drugs to prevent and treat:
 - Diarrheal diseases
 - Respiratory diseases
 - Hepatitis E
 - Malaria
 - Arboviral diseases
 - HIV
 - Rickettsial diseases

Examples of Products Under Development:

- | | |
|---|---|
| • Extended Duration Repellent, permethrin, insect repellent | • Campylobacter, IND vaccine (whole cell inactivated) |
| • JE vaccine | • Hepatitis A, vaccine (inactivated) |
| • Halofantrine, antimalarial | • Argentine Hemorrhagic Fever vaccine |
| • Tick Borne Encephalitis vaccine | • Shigella flexneri vaccine recombinant vaccine |
| • ETEC vaccine whole cell inactivated | • Azithromycin anti-malarial |
| • Hepatitis A&B combined vaccine | • Korean Hemorrhagic Fever vaccine |
| • Mutant labile enterotoxin mucosal adjuvant | • Shistosoma Topical Antipenetrant skin cream |
| • Halofantrine prophylactic anti-malarial | • Chikungunya vaccine live vaccine |
| • WR238605 antimalarial drug | • Cholera vaccine whole cell plus B subunit |

- ETEC vaccine microencapsulated
- Rift Valley Fever vaccine live virus vaccine
- WR6026 anti-leishmanial drug
- Plasmodium falciparum vaccine blood stage vaccine
- Arteether anti-malarial drug
- Meningococcal Group B vaccine subunit vaccine
- Hepatitis A vaccine live virus vaccine
- Leishmania skin test
- P. vivax vaccine multistage vaccine
- Hemorrhagic Fever Renal Syndrome vaccine recombinant vaccine
- Dengue vaccine multivalent vaccine

Diving and Submarine Medicine

Program Officer for Submarine and Diving Medicine

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Current research is focuses on solutions to medically-related problems identified by the Navy's submarine, diving, explosive ordnance disposal, and special warfare communities. These include efforts focused on submarine rescue/escape, deep water recovery, underwater construction, explosive disposal (EOD), special team (SEAL) operations, exposure to low frequency underwater sound, and other diving scenarios. Current research also examines the areas of sonarman performance, qualifications for submarine duty, and methods to improve crew health and safety. Special warfare research focuses on personnel performance, performance enhancement in extreme environments, and exercise-related injuries.

Current efforts focus on:

- Biophysical effects of low frequency sound on divers
- Biochemistry of Oxygen-Inducted convulsions
- Mathematical model of tissue inert gas exchange kinetics
- Simultaneous and successive color contrast
- Active Noise reduction stethoscope for Navy application
- Development of Performance Enhancement Methodologies for Special Operations personnel
- Neuroanatomical and neurophysiological substrates of oxygen-induced convulsions
- Submarine mortality study update
- Enhancement and utility off synthetic auditory environments
- Oxygen toxicity in the central nervous system
- Medical disqualified submariners and return to duty
- Hydrogen/Nitrogen biochemical decompression

Examples of Products Under Development:

Probabilistic Algorithm for Air Decompression	A decompression model based on statistical analysis of a defined database which will increased safety parameters for the deep air diving/multi-level capability Diver Planner (Version 6.0).
Saturation Abort Tables	A procedure to provide safe desaturation for submariners exposed to saturation during disabled submarine scenarios.
Predictive Model for CNS Oxygen Toxicity	A safety capability model of a reliable marker of CNSO ₂ toxicity to predict onset of oxygen toxicity for single or multi-level dives.
Procedures for O₂ decompression for Special Warfare	Methods to extend O ₂ tolerance and cut decompression time five fold.
High O₂ Helium Decompression tables	Special Warfare tables for new work in diving rig which reduces decompression time for deep mine countermeasures missions.
Underwater Decompression Meter	A decompression computer that calculates "real time" decompression requirements and calculates "best possible decompression schedule". Markedly improves Naval Special Warfare capability to perform multilevel diving associated with SEAL Delivery Vehicle, Dry Deck Shelter operations.
Use of Color Contrast to Enhance Navigational Aids	Defines optional use of color contrast to enhance visualization of the environment and recognition of navigational aids.
Identification of Individual Susceptibility to Oxygen Toxicity	This program identifies individual susceptibility to oxygen toxicity. This capability could be used in selection of Naval Special Warfare personnel required to use 100% oxygen rebreathers.
Sonar Headset and Signal Shapers	Active noise canceling headsets and sonar signal shaping filters for use in submarine sonar rooms. Submarine COs report detection and classification of targets earlier with this package.
Underwater Sound Guidance	Developed to reduce the probability of injury to Navy divers by establishing safety exposure limits for civilian and military divers operating within range of an advanced low frequency sonar system.
Underwater Sonar Guidance	Allows simultaneous sonar transmission and diving and reduces the probability of diver injury.
Rescue Manual (Update)	Pressurized submarine rescue manual for medical officers/ submarine fleet which maximizes probability of survival from disabled submarines.
Active Noise Cancellation Stethoscope	Develop an active noise reduction stethoscope for field and shipboard use in noisy environments which will improve treatment and health care of casualties in a variety of high noise settings.
Revised SUB Medical Qualifications Guidance	This will determine if current medical qualification criteria for renal stones is data-based. Waivers have resulted in an estimated savings

	of \$4.5M in manpower over four years and prevented 220 submariners from being disqualified.
Medical Test Procedures	Medical procedures for conduct of submarine hull compartment and sonar dome pressurization test which reduced probability of casualty due to improper ventilation and pressurization.
Psychiatric Screening	Revised, standardized procedures for psychiatric screening for submarine service which screens out at-risk candidates for submarine service; reduces the probability of MEDEVACs.
SEAL Delivery Vehicle (SDV) Operator Performance Measurement System (OPMS)	A software system that captures and stores operator performance measures of critical tasks in SDV simulator. The multi-million dollar SDV and SDV simulator lack a quantitative method of evaluating operator performance
Calisthenics Guidelines for Special Forces	Published descriptions and photos demonstrating proper techniques to reduce musculoskeletal injuries and improve training efficiency.
Underwater Sound Protection Device for Divers	Protection from bioeffects for divers exposed to intense underwater sound. No means exists to monitor low frequency acoustic active sonar exposure on submerged divers.
Medical Data Analysis System	Research tool to track incidence of illness and injuries for research and produce routine reports. Quantification of outpatient visits for improved management and treatment
Psychological Screening Tests for Basic Underwater Demolition /SEAL Candidates	MMPI and NEO5 factor personality inventory scores correlated with probability of attrition to reduced student attrition (\$136K/student) and improved instructor allocation.
Improved Treatment of Iliothibial Band Syndrome	Phonophoresis with 10% hydrocortisone: Return to duty 6 days sooner than standard treatment.
SDV Operator Performance During Cold Water Missions	Database of physiologic responses and thermal status of SEALs during prolonged cold water immersion. Improved mission planning and probability of success.
Carbon Dioxide Sensor	Development of CO ² sensor/alarm system to warn of hazardous CO ² levels in closed circuit rebreathers.
Atmospheric Guidelines for Rescue and Escape	Establishes survival times in disabled submarine scenarios to determine DSRV deployment schedules.
Ice Cooling Vests Technology Transfer for use in Hyperbaric Chambers	Technology transfer certification/approval to use Steele Ice Vest in hyperbaric chambers.
Landing Craft Air Cushion Crew Medical Standards	Changed 107 MANMED to establish medical standards for LCAC crew, reduced loss of life and improved safety for LCAC crew.

Carbohydrate Loading Protocol	Protocols to achieve and maintain muscle glycogen supercompensation. Improved endurance, performance and mission success.
Photo-Refractive Keratectomy	Approval to use PRK on myopic military personnel. Long-term reduced costs of glasses and eye exams.
Hyperbaric CO² Analyzer	Portable CO ² analyzer for use inside Dry Deck Shelters.
Revised Dry Deck Shelter Air Purity Guidelines	Procedure to screen submarine air bank gas prior to DDS operations.

Fleet Occupational Health

Program Officer for Fleet Occupational Health

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In certain operational environments Sailors and Marines are at risk of exposure to physical, chemical, and biological hazards that may threaten their health and degrade operational performance. Techniques for understanding the mechanisms of injury and disease associated with these environments are being developed to reduce or prevent injury, improve safety, and optimize mission effectiveness. Scientists are focusing on Navy-specific operational scenarios to establish effective standards for occupational safety and health, environmental protection, damage control, and fire prevention. In determining exposure limits, researchers are concentrating on areas of study that include heat, noise, vibration, atmospheric contaminants, and various forms of electromagnetic radiation including lasers. The resulting research data are used to develop models predicting human exposure consequences in actual use situations, to tailor exposure limits for operational conditions and to recommend medical surveillance and treatment guidelines. Researchers also are investigating the effects of life style factors including obesity, hypertension, smoking and drug use on military readiness.

Current efforts focus on:

- The assessment of biomedical risk and development of safe exposure criteria for:
 - Noise
 - Lubricants
 - Hydraulic fluids
 - Freon replacement compounds
 - Solvents
 - Propellant
 - Radio frequency energy
microwaves

A noteworthy accomplishment is the Navy's key role in the development of a tri-service Deployment Toxicology Research and Development Plan. This Plan's goal is the development of tools that can be used by deployed operational forces to assess risks from the intentional or unintentional release of toxic industrial chemicals.

Examples of Products Under Development:

Enhanced hearing protector	An Earcup device made with super noise-absorbing material. Veterans' medical compensation for hearing loss exceeds \$230 million annually. This device could reduce costs 10% or more.
NAVOSH Quality Assessment Model	Computer model that analyzes safety and health statistics to identify intervention opportunity. This model will reduce lost time injuries and illnesses for military and civilian personnel.
Bioeffects of High Power Microwaves	Data on the bioeffects of non-ionizing radiation. This data will be used in the development of exposure standards for microwaves. An important study, which concluded this year, that defines safety levels of exposure to pulsed microwaves.
Neurobehavioral Toxicity Assessment Battery	Tests used to rapidly screen materials for neurotoxicity. 10,000 new or reformulated hazardous materials are added to Navy inventory each year. These tests will permit screening candidate materials and will be the basis of a new generation of neurotoxicity screening methods.
Neuromolecular Toxicity Assessment System	A suite of <i>in vitro</i> and <i>in vivo</i> tests that can be used to rapidly screen materials and novel exposures to neurotoxicity. This system is based on measuring biomolecular mechanism and will save time and money and will also minimize the use of animals during toxicity testing.
Toxicity Assessment of a Submarine Contaminant	Comprehensive scientific investigation of toxic effects. Published data on the toxicity of DBNP contaminant in submarines. Needed for procurement guidance on lubricants.
Transcutaneous Analyte Measurement device	Non-invasive blood analyte detector. Potential life-saving treatment on battlefield and aboard ship by eliminating lab turn around time.

Aviation Medicine and Human Performance

Program Officer for Military Operational Medicine

CAPT D. McBride, MSC, USN

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The Aviation and Human Performance Program plays a vital role in protecting warfighters from battle and non-battle operational conditions that are unique to the naval aviation operational environment. Naval aviation differs significantly from that of other services operating in a maritime environment, including those conditions associated with the aircraft carrier and other air-capable ships. The goals for aviation medicine research are to protect military personnel from current and emerging operational, environmental and materiel hazards, enhance individual and unit performance under all operational conditions; develop performance models and realistic system safety/design criteria; quantify performance criteria to improve

operational concepts and doctrine, and provide biomedical products and information in support of naval aviation system acquisitions.

Current efforts focus on:

- Development of a vestibular function test (Unilateral Otolith Function Test) for evaluating pilot applicants.
- Demonstration of new physiological and neurophysiological approaches to the dynamics of spatial orientation.
- Development of prototype tactile interfaces to improve aviator selection test battery.
- Development of situation awareness in flight environments.
- Fielding of training and design recommendations to combat the effects of night vision device-induced visual distortion on safety of flight
- Performance evaluation of enhanced night vision devices and training aids.

Examples of Products Under Development

Agile Laser Eye Protection Prototype	Nonlinear optical materials that provide day/night usable eye protection against frequency agile lasers. Increase protection for personnel from emerging threat of lasers to aviators. Savings dependent on extent of laser weapons obtained by future adversaries.
Female Ejection Injury Threshold Model	Provide biomedical information for ejection seat designers to reduce immediate threat of lumbar and thoracic spine injuries to females and small stature males. Reduction of injury and possible loss of life during ejections. Cost savings unknown due to small number of females in combat aircraft. Estimate conservatively \$100K/female/non Class A ejection.
Prototype Vibrotactile Display	Vibrotactile suit provides aviator tactile feedback of his/her position in space while flying. Also provides special warfare divers navigational and threat information. Provides better orientation cue for aviators, reducing a major contribution to aircraft mishaps. Prevention of one F/A-18 spatial disorientation aircraft accident per year equates to a savings of \$36.8M.
Unmanned Aerial Vehicle (UAV) Operators Selection Test Battery	Medical and performance standards for screening candidates for entrance into the UAV External pilot or internal training program. Reduce attrition during training resulting in savings of training costs of \$300K/year.
Helicopter Instrument Scan Pattern Tracker	Noninvasive eye tracker for 2B42 flight simulator which provides feedback to instructor on student instrument scanning behavior. Break down of visual scan pattern has been a contributing factor to naval aircraft accidents. This device will provide training aids to develop improved eye scan behavior.

Performance-based Occupational Strength Test	Test battery to identify individuals capable of meeting specific strength performance requirements to safely conduct flight operations. Provides biomedical information for screening men and women for aviation aircraft and for design of new aircraft.
Portable Unaided Night Vision Training Kit	Instructor kit for training of biomedical effects on humans during night operations. Provides biomedical performance information and strategies for safe operations during night operations. Replaces four aviation training devices resulting in a cost savings of \$62K/training site. Increases safety of flight during night operations. This kit has been transitioned into civilian production.
Night Vision Goggle (NVG) Focusing Aid	Eye piece focusing aid for NVGs. Eliminates the need for a 21 foot light-tight room for aircrew to focus their NVGs. This product has been patented; licensing for production is in the discussion stages.
Landing Craft Air Cushion (LCAC) Selection System	An automated cognitive and psychomotor test battery to predict LCAC operator, engineer, and navigator training and fleet performance. Reduced crew attrition from 40% to under 10%, a \$420K/year training cost savings.
Sleep Management Guide	Provides biomedical information support for operational commands to assist in decisions and planning regarding sustained operations. Reduce accidents by reducing performance degradation due to fatigue from sleep loss.
Color Night Vision System	A sensor-fusion device combining visible and thermal infra-red information to deduce color and heighten contrast. Reduce NVG related aircraft mishaps. Between 1987 and 1993, 13 rotary wing and 5 fixed wing Class A mishaps employing NVGs occurred. System reducing Class A mishaps under NVGs by 10% will result in cost savings of \$60M over a five year period.
Work/Rest Guidelines for Damage Control Personnel	A modified Physiologic Heat Exposure Limit for male and female workers in protective wear. Reduce number of heat exhaustion cases for damage control personnel.
Cognitive-Behavioral Motion Sickness Desensitization Training Program	Protocol to return student aviators, who experienced severe motion sickness, to training-- 80% effective. Cost savings of training investment of \$25K/student returned to training.
Neuro-Otological Assessment Battery	Vestibular/spatial orientation tests to evaluate pilot applicants and motion sickness/vertigo/disorientation referrals. Screen candidates predisposed to experiencing a partial disorientation, but whose deficiencies cannot be detected by current clinical tests. Reduce likelihood of aircraft accidents due to spatial disorientation.

Human Performance Cold Operations Model (HPCOM)	HPCOM will predict safe exposure times for flight deck and amphibious operations. Reduce decrements in human performance associated with flight deck operations during cold weather operations.
Laser Threat Assessment Tool	Develop a PC-based laser threat assessment tool for mission planners who expect to encounter laser threats in a joint Navy and Air Force team. Reduce mission abort or failure due to laser attacks on naval aviators.
Temporal Acuity Vision Test Battery	Screening tool to determine temporal acuity of aviation candidates. Savings training funds by reduction of failures during advanced training.
Naval Aviation Medical Criteria Methodology	Methodology for evaluation of effects of therapeutics considered for using while flying. Decrease time to return aviators to duty in a flying status after injury or illness.
Standards for visual acuity for photorefractive karyotectomy (PRK)	Patients returning to flight and diving duty.
Women at Sea Medical Tracking program	Epidemiological tools for planning sustained operations. Improved health care delivery at the deckplates for women at sea. Strength standards for women in tactical air and other demanding operational environments.
ISO Performance Algorithms	Tracking aptitude with non-cognitive (medical and other) factors for personnel screening, assignment, and retention.
Clinical Trials	Clinical trials for confirmation of success of anti-oxidant pharmaceuticals in preventing noise-induced hearing loss.
Joint Medical Operations	Telemedicine and advanced concepts technology demonstration under the direction of the Command Surgeon, USCINCPAC.

Dental Readiness Research

Program Officer for Dental Readiness Research

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Dental emergencies and diseases significantly impair operational readiness and sustainability. Sailors and Marines are frequently deployed on ships or in areas with no immediate access to dental care. In these deployed settings, acute dental problems could jeopardize a multi-million dollar mission. These military-unique situations require dental research to characterize patient populations, identify better diagnostic and risk assessment techniques, and develop better dental treatment techniques, materials, and equipment.

Current efforts focus on:

- Identification of patients at high risk for dental disease and emergencies
- Characterization of dental emergencies during operational deployments
- Rapid, simplified, and improved diagnostics techniques and tests
- Epidemiologic assessment of treatment needs among active duty personnel
- Evaluation of preventive and treatment methods and materials that promote operational dental readiness and dental wellness

Examples of Products Under Development:

Dental Emergency profiles	Determine the impact, risk factors, and predictors of dental emergencies. Provide essential information for planning risk assessment, treatment, and improving dental readiness.
Determination of bisphenol A in dental sealants	A program to assess the presence of bisphenol A, bisphenol A dimethacrylate and bis-GMA in dental sealants and reassess the safety of dental sealants.
Tobacco cessation effectiveness	A program to evaluate effectiveness of commercially available cessation programs. Develop ongoing support technology to decrease recidivism and promote wellness of personnel.
SMART Card	A project to modify the SMART card by adding a dental component and to track patients, dental treatment needs, and outcomes. Tasking is to develop and test a dental component for this technology that will serve as an electronic interface with DENMIS DDSS, and CHCS. Tracking patients is essential to improving dental readiness.
Dental remote site multimedia diagnostic aid for Independent Duty Corpsmen	Fielded a dental multimedia diagnostic system to improve the capability of independent duty corpsmen to diagnose and treat emergency dental conditions at remote or isolated duty stations. The software includes radiographic diagnosis and teledentistry modules; prototype delivered with beta testing in process. Cost benefit tied to improved patient care capability by non-dentists and decreased MEDEVACs.
Rapid chairside test for periodontal diseases	A 5-minute rapid chairside test for microbial proteases produced by periodontopathic bacteria has been developed. A second 5-minute rapid immunoassay for periodontopathic bacteria has also been developed. Both will form the basis of a periodontal disease risk assessment program. Prototype test kits being manufactured by industrial partner; two patents pending. Allows rapid screening of personnel for risk of developing periodontal diseases; can be done at one appointment; nothing comparable available commercially; cost benefit linked to reduced dental emergencies and managed dental care program.

Rapid chairside test for dental caries	A 5-minute rapid chairside test for <i>S. mutans</i> has been developed. This will be the basis of a caries risk assessment program. The current commercial technology requires 48 hours. Prototype test kits have been manufactured by industrial partner (patent pending). Allows caries risk assessment to be made at one appointment; nothing comparable available commercially; cost benefit tied to managed dental care program.
Rapid Chairside Tests for militarily relevant diseases	Field-test a 5-minute chairside test. Develop immunoassays for rapid assessment of antibodies in saliva to disease-related antigens for such diseases as tuberculosis and hepatitis (patent pending). Allows rapid screening for diseases to be made at one appointment without complicated laboratory tests which will result in significant cost reductions. Can be performed by auxiliary personnel.
Managed Dental Care Effectiveness	An ongoing study to evaluate the effectiveness of prioritized dental care. A pilot study was conducted at RTC Orlando, resulting in adoption of Managed Dental Care system by BUMED for Navy-wide implementation. This is a dental readiness initiative which has as its central focus the conversion of dental class 3 patients to class 2 and dental class 1. Anticipated multi \$M cost reduction primarily through improved dental readiness.
Multimedia dental examiner standardization system (Image Quiz)	Delivered a multimedia teaching aid to assist dental commands in the standardization of their dental examiners. Will allow computerized evaluation of provider standardization. This is an essential element of the managed dental care program. System delivered in Aug 1997.
Risk Assessment Program	Develop a risk assessment program to include methods to assess dental disease activity and disease progression; develop a non-invasive method to accurately assess periodontal disease activity; develop method with 2-D gel electrophoresis to assess disease activity indicators. By knowing risk, treatment resources can be directed in the most efficient and effective manner; dental emergencies can be reduced; and readiness increased.
Alternative 3rd Molar treatment strategies in women	This research is directed towards estimating the incidence of post-extraction complications as a function of risk factors such as menstrual cycle. Can generalize findings to any elective surgery in women resulting in decreased post-operative complications; significant man-hour savings.
Naval Dental Sealant Program effectiveness	This is the first investigation of sealants in a military patient population. Sealants are a cost effective preventive method for caries in children that could be used by auxiliaries. If this technology translates to young adults, there could be an estimated dental treatment cost reduction of up to 29%.

A restorative technique	Develop a material that can be used with minimal instrumentation by the IDC to restore caries and lost restorations (40% of dental casualties) in the field. Restorations should have symptom-free longevity of 6 months, prevent MEDEVACS and return personnel to duty in 15-20 minutes without the intervention of a dental officer.
Failure analysis of restorative materials	Determine failure analysis of restorative materials to optimize materials and decrease treatment failure when employed under military circumstances. Includes sensitive and highly visible effort to investigate mercury-free amalgam. Many commercial materials are unsuitable for military use and require development of "field friendly" storage and delivery systems..
Mercury Amalgam Separator, Clinic	A prototype system was constructed which effectively removes soluble and insoluble mercury from dental waste water; suitable for large clinic use; in use at NDCs Norfolk and Great Lakes. An industrial partner has been identified and a patent is pending. Savings of approximately \$150K a year per site.
Mercury Amalgam Separator, Field	Apply clinic level technology to field/afloat size facilities. Prototype device was constructed which effectively removes particulate mercury-containing amalgam from dental waste water. Suitable for small clinic or chairside use (patent pending). Potential to save approximately \$5K per dentist per year compared to contract disposal of waste water
Characterize dental waste water	Characterized mercury-containing dental waste water from Navy dental treatment facilities. Provides fundamental information necessary to develop optimum ways to address this problem. EPA certification of NDRI for mercury analysis achieved in FY97. Provides the scientific basis for addressing the problem of mercury in dental waste water.
Optimum treatments for acute endodontic and periodontic conditions	Assess optimum periodontal and endodontic treatments suitable under military circumstances including clinical treatments for oral inflammatory conditions which may cause acute pain, swelling, systemic manifestation, and tooth loss, there by impairing readiness.

The Laboratory System in brief

Naval Medical Research and Development Command (NMRDC)

An NMRDC staff officer is assigned as the Research Area Manager (RAM) for each program area. The RAMs are the central contact points between the laboratories, where the research takes place, and headquarters, where budget decisions are made and research planning and execution policy is established. The RAMs manage both intramural and extramural research activities. The in-house research efforts are complemented by a contract and grant program with universities and private industry.

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homepage: <http://www.dmsd.mil/NMRDC/>

Naval Aerospace Medical Research Laboratory (NAMRL)

Current research is directed at the development of performance-based biomedical standards for Navy and Marine Corps air crews; the development of methods to enhance aircrew performance, aviation selection and assessment, and human factors engineering; and the development of methods to protect personnel from environmental hazards associated with naval aviation operations.

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homepage: <http://www.namrl.navy.mil/>

Naval Submarine Medical Research Laboratory (NSMRL)

Scientists are conducting basic and applied research in the biomedical and behavioral sciences aspects of submarine, hyperbaric, and diving environments. Scientific fundamentals are being established for the continued expansion of the physiological limits and capability of man in the sea, whether in diving or closed-habitation mode.

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Groton, CT 06349-5900

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email: WALTER@nsml.navy.mil

Naval Medical Research Institute (NMRI)

Scientists conduct research in a wide variety of biomedical disciplines; current interests include the physiology of thermal stress and thermal adaptation, biochemistry, pathophysiology and histopathology of sepsis and wound repair, immunology, infectious diseases, molecular biology, electrophysiology, and diving medicine and bioengineering.

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homepage: <http://131.158.70.70/>

Naval Medical Research Institute Detachment (Toxicology) (NMRI/TD)

This detachment is part of a Tri-Service Toxicology Consortium and the Navy's sole toxicology research laboratory. Current programs focus on toxicology of materials in operational environments. The resulting research data are used to develop predictive models for operational exposure scenarios, to develop more accurate and protective exposure limits tailored to the exposure circumstances, and to recommend medical surveillance and treatment guidelines for potentially exposed personnel.

CAPT(S) K.R. Still, MSC, USN, Officer-in-Charge Naval Medical Research Institute Detachment (Toxicology) NMRI/TD BLDG 433 2612 Fifth Street Wright-Patterson, AFB, OH 45433-7903	phone: 937-255-6058 (DSN 786-6058) email: kstill@navy.al.wpafb.af.mil homepage: http://www.navy.al.wpafb.af.mil/triinfo/navy.nmrtd.htm
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Naval Medical Research Institute Detachment (NMRI Det)

This is the only Navy medical facility in South America. Research focuses on the diagnosis and treatment of infectious diseases of military importance in South and Central America.

CAPT M. Wooster, MSC, USN, Officer in Charge Naval Medical Research Institute Detachment/Unit 3800 American Embassy APO AA 34031	phone: 011-51-1-561-2733 email: oic@namrid.sld.pe
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Naval Medical Research Institute Detachment (Brooks) (NMRI Det (Brooks))

Commissioned in October 1994, this detachment is part of a tri-service electromagnetic radiation bioeffects research group. The detachment's primary mission is to conduct research, development, testing and evaluation on the biomedical effects of electromagnetic radiation.

LT R. LeBlanc, MSC, USN, Officer-In-Charge Naval Medical Research Institute Detachment Brooks AFB 8308 Hawks Road Brooks AFB, TX 78235-5324	phone: 210-536-4699 (DSN 240-4699) email: randal.leblanc@navy.brooks.af.mil homepage: http://www.brooks.af.mil/NMRI/nmri.htm
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Naval Health Research Center (NHRC)

Research efforts at NHRC focus on operational epidemiology, medical operations research, medical and performance modeling, operational performance assessment and enhancement, medical informatics, health promotion, readiness standards, and the effects of continuous operations.

CAPT L. M. Dean, MSC, USN, Commanding Officer Naval Health Research Center P O Box 85122 San Diego, CA 92186-5122	phone: 619-533-8428 (DSN 553-8428) email: co@vax309.nhrc.navy.mil homepage: http://www.nhrc.navy.mil
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Naval Dental Research Institute (NDRI)

This facility conducts research in fleet and field dentistry and is the only DoD laboratory dedicated to combat dentistry and oral disease research. Navy dental research exists primarily to increase operational readiness and the results of dental research directly impacts every Sailor and Marine.

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homepage: <http://support1.med.navy.mil/ndri/>

Naval Dental Research Institute Detachment Bethesda (NDRI Det Bethesda)

This detachment is responsible for coordination and guidance of resident research performed as part of postgraduate specialty education, and for support of staff research projects.

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Naval Medical Research Unit No. 2 (NAMRU-2)

Scientists at NAMRU-2 conduct research on the diagnosis and treatment of infectious diseases. The majority of tropical infectious diseases of military importance occur in Indonesia.

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APO, AP 96520-5000

email: PETERSEN@SMTP.NAMRU2.GO.ID

Naval Medical Research Unit No. 3 (NAMRU-3)

NAMRU-3 scientists conduct a multi-faceted basic, clinical and field research program relating to the health and operational readiness of military personnel assigned or deployed to Southwest Asia or Africa.

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Intellectual Property

PATENTS

Why the Government files patents

The Government's interest in patents parallels that of private industry even though the Government does not compete in the commercial market. Two reasons exist for the Government to obtain patents. The first reason is for defensive purposes. A patent owned by the Government precludes another party from obtaining a patent on the same invention and asserting it against the Government. The second reason is that a patent may be used to transfer technology developed with Government research and development funding to the public and private sector. The patent which the Government receives may be licensed to interested parties who agree to commercialize the invention for the benefit of the general public.

There are two major sources of inventions in which the Department of the Navy acquires rights for the benefit of the Government. The first is from its military personnel and civilian employees, primarily those who work in laboratories or are involved in research and development activities. A second source is from contractors/grantees performing work under Navy research and development contracts/grants. The Government may acquire either a license to use these inventions or full ownership of the inventions, depending upon the circumstances.

Each Federal Agency is authorized by statute to license federally-owned patent applications, patents and other forms of protection obtained either on a royalty-free or royalty-bearing basis. The statute authorizes the granting of nonexclusive, exclusive or partially exclusive licenses. The Secretary of Commerce is authorized to promulgate regulations specifying terms and conditions upon which federally-owned inventions, other than inventions awarded by the Tennessee Valley Authority, may be licensed.

Patents issued to NMRDC in 1997

US Patent 5,665,559 Production of Monoclonal Antibodies to Bacteroids Gingivalis by Hybridoma BGII, VF9/2D	Abstract: A monoclonal antibody is disclosed which is reactive to <i>Bacteroides gingivalis</i> and produced by the hybridoma deposited under ATCC HB 9968. The invention also discloses diagnostic reagents and methods for detecting <i>Bacteroides gingivalis</i> utilizing the hybridoma deposited under ATCC HB 9968.
US Patent 5,630,410 Accelerated Gas Removal from Divers' Tissues Utilizing Gas Metabolizing Bacteria	Abstract: Decompression from dives using nitrogen or hydrogen as a diluent gas are accelerated by introducing into the large intestine an enzyme or, preferably, non-toxic bacteria from the group that metabolizes hydrogen or from the group that metabolizes nitrogen. The bacteria are encouraged to multiply and feed on the hydrogen or nitrogen (dependent on the gas mixture used in the dive) by metabolizing the diluent gas released into the large intestine and the new product is vented from the large intestine. The metabolism of the hydrogen or nitrogen causes a reduction of the partial pressure of the metabolized gas in the large intestine thereby increasing the diffusion of the metabolized gas from the blood and surrounding tissues into the intestine. The delivery of the bacteria is accomplished by any one of several means with packaging of the enzyme or bacteria in enteric coatings for oral ingestion as the preferred means.

US Patent 5,627,521 Personal Microwave and Radio Frequency Detector	Abstract: A self-contained personal microwave and RF detector, which includes, inter alia, the housing and associated electronics of a standard hearing aid, is configured to produce an audible indication to a wearer thereof in response to electromagnetic fields of dangerously high levels within predetermined frequency ranges.
US Patent 5,599,703 In Vitro Amplification / Expansion of CD34+ Stem and Progenitor Cells	Abstract: The present invention relates to a method of amplifying in vitro stem cells. In this method hematopoietic CD34+ stem and progenitor cells are isolated from human bone marrow and contacted with endothelial cells. The contacted stem cells and endothelial cells are cultured in the presence of at least one cytokine in an amount sufficient to support amplification / expansion of the hematopoietic CD34+ stem and progenitor cells. This method produces increased yields of hematopoietic CD34+ stem and progenitor cells which can be used in human therapeutics.
US Patent 5,599,543 Immunogenic Four Amino Acid Epitope Against Plasmodium vivax	Abstract: An agent and pharmaceutical formulations of the agent containing a synthetic peptide of the human malaria Plasmodium vivax, containing at least one repeat of a synthetic peptide having the amino acid sequence Ala-Gly-Asp-Arg (AGDR) which is a protective epitope found on the circumsporozoite (CS) protein of the sporozoites of the human malaria Plasmodium vivax. When a monoclonal antibody specific for this four amino acid sequence binds to the CS protein of the P. vivax sporozoite in vivo, infection is prevented.
US Patent 5,596,090 Antisense Oligonucleotides Directed Against Human VCAM-I RNA	Abstract: Antisense oligonucleotides complementary to human mRNAs or pre-mRNAs coding for VCAM-I are used in a therapeutic treatment of sepsis (sepsis, the sepsis syndrome, septic shock and all other manifestations of the sepsis disease, including but not inclusive of, adult respiratory distress syndrome, multi-organ failure, or cardiovascular dysfunction).

Cooperative Research and Development Agreements

A Cooperative Research and Development Agreement (CRADA) is a special type of agreement provided by Congress to advance technology transfer. Under a CRADA, a Federal Laboratory can "accept, retain, and use funds, personnel, services and property from collaborating parties and provide personnel, services and property to collaborating parties." The following is a list of current CRADAs between the NMRDC laboratories and non-Government partners.

List of NMRDC CRADAs Currently in Effect 1997

NMRI / PharMingen NMRDC 010 (DTIC N0002500)	Goal: To identify, develop and manufacture products from a Government developed mouse x mouse hybridoma cell line which produces at least a monoclonal antibody
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NAMRU-3 / Merck & Company, Incorporated (b) NMRDC 090b (DTIC N0002516)	Goal: To investigate, develop and optimize Merck's recombinant vaccine for prevention of Hepatitis B in newborns.
NMRI / Genelabs Technologies, Incorporated NMRDC 293 (DTIC N0002518)	Goal: NMRDC/NMRI has a library of Hepatitis sera that will be provided to Genelabs for evaluation by Genelabs' Proprietary techniques. Data on those evaluation results will be provided to NMRDC/NMRI
NDRI / Jolley Consulting and Research, Incorporated NMRDC 330 (DTIC N0002520)	Goal: To develop a dental/medical diagnostic instrument which is based on recombinant DNA produced monoclonal antibody fragment labeled with a fluorescence dye and detected by a fluorescence polarimeter.
NMRI / MicroCarb, Incorporated NMRDC 341 (DTIC N0002523)	Goal: To develop, test and evaluate candidates for the large-scale production of a safe and effective vaccine for the prevention of diarrhea caused by enteropathogenic Campylobacter in humans.
NAMRL / M.C.J. Corporation NMRDC 369 (DTIC N0002524)	Goal: To develop effective therapies for various forms of vestibulopathology, to include motion sickness, dizziness, headache, spatial disorientation, Meniere's Syndrome, post-head injury and post-traumatic vertigo patients utilizing non-invasive vestibular stimulating apparatus.
NMRI / Kara Biologicals Diagnostic Research and Development NMRDC 402 (DTIC N0002528)	Goal: To utilize reagents, clinical and environmental samples, developmental rapid diagnostic and detection technologies and field evaluation capabilities of NMRI in combination with the diagnostic reagent production, diagnostic assay production optimization and assay production capabilities of KBDRD to produce rapid diagnostic/detection assays for a variety of bacterial agents, toxins and antibodies to these agents.
NMRI / GenPharm International, Incorporated NMRDC 354 (DTIC N0002530)	Goal: To develop and test, and hopefully manufacture and market, various human monoclonal antibodies produced in mice for their capacity to protect against <i>P. falciparum</i> and <i>P. vivax</i> malaria in monkeys and in humans.
NMRDC / Biomedical Visualization International, Limited Liability Company NMRDC 406 (DTIC N0002531)	Goal: The creation of a surgical simulator for training in neuroendoscopic surgery. There are three tasks: (1) the creation of three-dimensional models representing tissue and structures of interest; (2) simulation of deformable objects and collision detection; and (3) development of a realistic, force-feedback interface to more realistically simulate the surgical procedure.
NAMRL / Planning Advantage NMRDC 407 (DTIC N0002532)	Goal: The exchange of intellectual data, technology and personnel in the development and marketing of unaided and aided night vision training kits for expanded applications in non-military settings. The Navy will be able to apply new technology developed during this process to mission specific specialties such as military police and special action teams.

NHRC / SecondWind Products, Incorporated NMRDC 427	Goal: NMRDC/NHRC's objectives are to reduce training-related musculoskeletal injuries in USMC recruits undergoing basic training at MCRD San Diego, to assess the general effectiveness of a polyurethane footwear insole in reducing such injuries, and to compare the effectiveness of the polyurethane insole to that of the PVC insole currently in use for this purpose at MCRD. SecondWind's objectives are to facilitate NMRDC/NHRC's study by providing the insoles required, and to use the results to improve their Cushion Replacement polyurethane insole and guide future product testing and development.
NMRI / Agracetus NMRDC 428	Goal: NMRDC/NMRI will provide genetic constructs encoding Plasmodium sp. proteins and experimental access to non-human primates (Aotus monkeys). Agracetus will provide the Accell gene gun, genetic constructs when appropriate and all appropriate materials and reagents for its use and all necessary personnel training in the use of the Accell gene gun. NMRDC/NMRI will perform experiments to test the efficacy of the Accell gene gun using relevant animal models of malaria (to include non-human primates and rodents). Although not an objective within the scope of this Agreement, if successful, these preclinical experiments are expected to lead to collaborative efforts by the Partners to prepare and test candidate vaccines using this delivery system in human subjects, eventually leading to the submission of appropriate documentation to the FDA seeking approval to market this vaccine delivery system for a Plasmodium sp. vaccine.
NMRI / Quantech Ltd. NMRDC 447	Goal: The technical objectives of this Agreement and expected results are as follow: (a) For NMRDC/NMRI to determine one or more appropriate technology platforms upon which a biosensor system can be developed for (i) biological defense, and (ii) environmental assessment and monitoring; in each case meeting such specifications as the U.S. Government may determine.
NMRI / Baxter Healthcare Corporation NMRDC 442	Goal: NMRDC/NMRI and Baxter will collaborate in a clinical research project to develop a large-scale system for CD4 T cells using NMRDC/NMRI proprietary procedures for in vitro expansion of polyclonal populations of T cells and Baxter proprietary procedures for cell culture and harvesting. The approach will be to modify a proprietary Baxter procedure for the removal of magnetic beads from cell culture medium. A second research aspect will be to characterize the use of clinical-grade monoclonal antibodies for the removal of unwanted cells from the culture system.

NHRC / The University of Alabama at Birmingham (UAB) NMRDC 444	Goal: NMRDC/NHRC and UAB will collaborate in conducting the protocol entitled "Risk Factors for Chorioamnion Infection and Adverse Pregnancy Outcome Among Military Women". NHRC will supervise data collection for this project which will occur in two phases: the pre-natal visit phase and the delivery phase. At the pre-natal visit, the subject will undergo a vaginal swab for bacterial vaginosis (BV) evaluation, a cervicovaginal culture, and a serum collection (blood collected by venipuncture). At delivery, women who undergo a cesarean section (CS) with intact membranes and a sample of 200 other women per year who deliver vaginally or CS without intact membranes will be studied further with a blood specimen, a vaginal swab, placenta culture, amniotic fluid specimen, cord blood and infant nasal secretions. Data from the patients' and infants' medical records will be collected by NHRC. NHRC will provide study data to UAB. UAB will study the clinical specimens for evidence of unusual pathogens as outlined in the study protocol. There will also be an additional 300 women delivering by Cesarean Section with ruptured membranes who will be enrolled in the study as well as 300 women delivering vaginally. NHRC will support UAB with epidemiologic analyses of laboratory and medical record data.
NMRI-Det / University of Washington Center for AIDS and STD NMRDC 445	Goal: NMRI-Det, an operational U.S. Navy unit working in Peru under a Navy-to-Navy Agreement, provides medical training and assistance to the Peruvian Navy. NMRI-Det will continue its Long-Term research on the epidemiology of HIV-1 and HTLV-I in cooperation with local Peruvian scientists, now in collaboration with the University of Washington. The previous studies have defined the prevalence and incidence of infection by these retroviruses, and have identified other sexually transmitted pathogens among high risk individuals in Peru. Retroviral research priorities have been refocused toward studies to identify the genotypes of HIV-1 in order to devise strategies for the development of candidate vaccines. This research will complete identification of the genotype of a limited number of HIV-1 isolates in Peru, and will extend these studies to include typing of isolates obtained from selected countries in Central and South America.
NMRDC / TransMedica Incorporated NMRDC 446	Goal: NMRDC and TransMedica will evaluate the effectiveness of certain non-invasive acoustic detection technology in diagnosing the presence of coronary artery disease in cardiac patients. TransMedica has developed certain proprietary non-invasive acoustic detection technologies capable of detecting and identifying coronary artery disease in patients, and has incorporated that technology in its products. TransMedica will provide those products to NMRDC for use in clinical medical testing to be undertaken by NMRDC cardiologists, will analyze the results of those tests, and will report its findings to NMRDC to verify the effectiveness of its non-invasive technology in identifying coronary artery disease.

NAMRL / Mold-Ex Rubber Company, Inc. NMRDC 449	Goal: NMRDC/NAMRL will cooperate to develop state-of-the-art sound attenuation materials usable throughout DoD, and with potential commercial application. The Navy will provide acoustic expertise and unique sound testing equipment, and Mold-Ex will provide samples of novel acoustic materials, manufacturing personnel, facilities and equipment to aid in the development of the new materials.
NMRI / Integrated Diagnostics, Incorporated (INDX) NMRDC 470	Goal: NMRDC/NMRI and INDX will perform cooperative research and testing to develop, validate, adjust and determine the usefulness of new serological tests for dengue and the rickettsial systems of scrub typhus, typhus and the spotted fever group. The results will be published, and NMRDC/NMRI will provide training to INDX personnel in the production of antigens and reagents required for the preparation of test systems.
NMRI / Arista Biologicals, Inc. NMRDC 475	Goal: NMRDC/NMRI and Arista will utilize reagents, clinical and environmental samples, developmental rapid diagnostic and detection technologies and field evaluation capabilities of the NMRDC/NMRI's Biological Defense Research Program in combination with the diagnostic reagent production, diagnostic assay production optimization, and assay production capabilities of Arista to produce rapid diagnostic / detection assays for a variety of bacterial agents, toxins and antibodies to these agents. This cooperative agreement will transfer the technologies and reagents developed in the Navy program to facilitate production optimization, evaluation and commercial production of these rapid hand-held diagnostic / detection assays by Arista.

Research Highlights

A Field Medical Surveillance System Model for Deployed Forces

During WWII over 55 million man-days were lost from duty as a result of infectious diseases. During Operation Desert Shield/Desert Storm large outbreaks of diarrhea illness occurred in US troops with incidence rates exceeding 10% of the force strength each week in some units, and it was estimated that during the first month of the operation at least 50% of all troops were affected. A research team at the Naval Health Research Center, San Diego is developing a model Field Medical Surveillance System to detect emerging health problems during combat conditions. Using an interface specific to military requirements, the system will incorporate GIDEON, a well known medical data base. GIDEON is the product of more than 13 years of intensive collaboration between specialists in infectious diseases, epidemiology, microbiology, biostatistics, and computer sciences. The first four program modules will focus on diagnosis, epidemiology, outbreak investigation, and surveillance. When complete, the system will have the ability to detect and monitor medical problems as they occur. With the development of portable computers and advanced communications this system will be available for use in the operational theater. For infectious diseases, early warning provided by surveillance systems allows field commanders time to start various control activities. These activities may include isolating ineffective cases, immunizations, spraying pesticides, chlorinating wells, restricting food-handlers, and eliminating sources of open water.

Researchers Develop a Tactile Interface to Improve Situational Awareness

Spatial Disorientation (SD) is a triservice problem that costs DoD in excess of \$300 million annually in lost aircraft. In aviation, SD occurs when pilots incorrectly perceive the attitude, altitude, or motion of their aircraft. The typical SD mishap occurs when the visual system is compromised (e.g., temporary distractions, increased workload, or reduced visibility). Researchers at the Naval Aerospace Medical Research Laboratory, Pensacola, FL have successfully tested the novel concept that spatial orientation can be continuously maintained by providing information about aircraft position to the pilot through the sense of touch. The approach uses a torso harness fitted with a pattern of tactors (miniature vibrators) that continuously update the pilot's awareness of position. The Tactile System can be connected to a portable sensor, or directly interfaced with aircraft instruments. The pilot will be able to maintain orientation without relying on vision. This device will free the pilot to devote more time to weapons delivery systems and other tasks requiring visual attention. A recently developed prototype has shown the feasibility of this approach. The Tactile System has many applications in Special Forces operations including non-audible communication; and sea, land or air navigation. This technology has applications to many motion platforms including aircraft, remotely piloted vehicles and submersibles and will impact all warfighting communities within DoD.

Researchers Evaluate Pack Designs for the Marines

In continuing efforts to support Marine Corps personnel, the Naval Health Research Center, San Diego, CA conducts laboratory and field studies to evaluate equipment. One recent effort addressed backpack design. A replacement for the all-purpose Lightweight Individual Carrying Equipment (ALICE) pack is being considered to reduce the risk of injury caused by carrying heavy loads on the shoulders. A research team compared 13 commercially available backpacks with the ALICE pack. This comparison was based on biomechanical, physiological, and subjective measurements of active-duty Marines carrying 100 pounds for four hours. The study concluded that certain aspects of several backpacks can be incorporated into a new backpack design including recommendations that: (1) the new backpack should include a waist belt that carries the load (shoulder straps are used only to prevent forward or backward rotation of the load) and prevents the hand-numbing effect of the ALICE, (2) the load should be carried as close to the center-of-mass as possible, so the pack frame should be as close to the back as possible, and (3) the frame needs to be strong but flexible, and the vertical frame stays should attach to the waist belt on the sides of the hip rather than the lower back (minimize lower back injury). The most important finding focuses on the fit, and the key measurement is the torso length (from top of shoulders to the top of hips). Any new backpack design must incorporate carriage of war-fighting supplies. The development of a new backpack will reduce injury associated with carrying heavy loads on the shoulders and enhance maneuver and sustainment on the battlefield.

The Malaria Genome Project

Malaria is the most important tropical infectious disease in the world today, with an estimated 300-500 million cases and 2 million deaths annually. For DoD, malaria presents a grave threat to operational readiness. In every war this century, millions of man-days have been lost due to malaria. In 1995, the DoD spent over \$4 million stockpiling antimalarial drugs and insecticides to prevent infection in Soldiers, Sailors and Marines, and yet drug resistance is spreading throughout the malarious world, rendering most of these antimalarials ineffective. No licensed antimalarial vaccine is yet available, though great progress has been made understanding the complex interactions of parasite antigens, the host's immune system and protective immunity. In fact, Navy malaria researchers are at the forefront of vaccine development and were the first to show that DNA immunization can protect against malaria. The present challenge is to find novel drug and vaccine targets that will circumvent the parasite's defenses. One way may be through uncovering the parasite's genetic "blueprints". Researchers at the Malaria Program at the Naval Medical Research Institute, Bethesda, MD, are working with other researchers at the Institute for Genomic Research (TIGR) and the Sanger Centre as part of an international consortium of molecular biologists, genome scientists and bioinformatic specialists, working on the enormous task of sequencing the entire genome (30 million bases of DNA) from the malaria parasite, *Plasmodium falciparum*. The Malaria Genome

Project is the largest microbial sequencing project to date and will splice together the entire genetic code of this important pathogen. Armed with the entire blueprint of the malaria parasite, malaria researchers will be able to design new drugs and vaccines. The Malaria Genome Project will provide the raw material for malaria researchers for at least the next decade.

Three Navy Patents Issued for Potential Treatment of Septic Shock

In combat a wounded Sailor or Marine may survive initial blood loss, only to succumb to multiple organ failure due to septic shock. Septic shock is the thirteenth leading cause of death in the United States with 100,000 deaths annually. Septic Shock may occur in the course of almost any severe infection. Most commonly, the infection is produced by gram-negative bacteria although other bacteria, viruses, fungi and protozoa may also be causes. The Navy received three patents for inventions for potential therapeutic treatments of septic shock. These treatments have the possibility of lessening morbidity and mortality by protecting against septic shock, Adult Respiratory Distress Syndrome, and other inflammatory complications of shock at the cellular level (these therapies involve antisense oligonucleotides which reduce expression of adhesive proteins).

Network System for the Remote Site Screening of Potential Aviators

The U.S. Navy spends \$1 million to train one pilot. The current screening test used for selecting eligible pilot candidates is the paper-and-pencil Aviation Selection Test Battery (ASTB), which is annually administered to thousands of applicants at over 200 remote sites worldwide. This test battery is used to determine which candidates have the necessary skills to earn their "Wings of Gold". The test battery degrades over time and new test items must continually be added for validation. The volume of testing and the numerous resources allocated for selecting and training aviators makes the ASTB an ideal computer oriented tool to be placed on the Internet. Researchers at the Naval Aerospace Medical Research Laboratory, Pensacola, FL, are developing a prototype computerized, worldwide web version of the ASTB. The goal of the research is to develop custom software for a secure, network-capable test battery that (1) can be downloaded remotely by verified users, (2) is equivalent to the paper-and-pencil test, and (3) is validated against flight performance. The software will use industry standard protocols and be evaluated using local networks. The computerized test battery includes test section timing, item marking, and backtracking. The system is designed to run on a minimum 486/25 computer, and remote site downloads of the entire test battery have been accomplished within two minutes using an Internet connection, and 5-10 minutes using a 28.8 modem connection. The network test system will (1) provide instant score reporting to recruiters, (2) improve test security and ease test compromise concerns, (3) decrease the administrative costs at the client and server ends, (4) help reduce attrition in the training pipelines by providing new test items, and (5) provide the potential for predicting advanced phases of flight training as more cognitively complex questions (i.e., 3-D mental rotation, etc.) can be included in the ASTB.

**Two Navy Researchers Receive
Award for Excellence in
Technology Transfer**

CAPT C.H. June MC, USN Retired and CAPT(SEL) David M. Harlan, MC, USN from the Immune Cell Biology Program at the Naval Medical Research Institute, Bethesda, MD received the 1996 Federal Laboratory Consortium Award for Technology Transfer. Technology transfer refers to technology exchange between federal laboratories, private industry and universities to further develop scientific research through collaborative efforts. In 1987, while researching new strategies for the treatment of combat injuries, Dr. June made the pioneering observation that the engagement of T lymphocytes requires activation of a specific surface receptor on the T cell called CD28. Dr. June and Dr. Harlan significantly contributed to demonstrating that blocking CD28 activation with antibodies and bioengineered molecules prevented T lymphocytes from reacting to foreign protein (or antigen) and rendered them permanently unresponsive (or anergic). This technology, called anergy therapy, has the potential to treat a spectrum of illnesses from the spectacular (organ transplantation) to the mundane (allergic reaction to poison ivy). This technology holds the potential to safely block unwanted immune responses without the severe side effects of current immunosuppressive drugs. Dr. June and Dr. Harlan have established a major ongoing transfer of technology through multiple cooperative agreements between the Navy, private industry and universities to continue the scientific and commercial development of anergy therapy, the clinical application of which may significantly improve medical treatment for a wide spectrum of human illness.

**Three Year Study to Investigate
Sopite Syndrome -- A Form of
Motion Sickness**

Sopite Syndrome is a form of motion sickness characterized by drowsiness, fatigue, difficulty in concentration, apathy, and mental depression. Long-lasting Sopite-like symptoms have been noted in operationally relevant settings and appear especially characteristic of simulator sickness. As the Navy shifts toward an increased use of simulators and virtual environments (VE) it is predicted that more frequent and stronger Sopite effects will be reported. Scientists at the Naval Aerospace Medical Research Laboratory, Pensacola, Florida are involved in a three year study to investigate Sopite Syndrome. The first year of the study focuses on the magnitude of Sopite symptoms and performance decrements in operationally relevant training environments. The second year will involve laboratory testing focusing on identifying the provoking stimuli. During the third year scientists will assess the biochemical and physiological changes in individuals susceptible to Sopite Syndrome. Anticipated products from this research include: (1) recommendations and guidelines for training systems design (conventional and VE simulators); (2) training for Navy medical personnel in the recognition, prevention, and treatment of the syndrome; (3) transition to on site research of motion and simulator environments; and (4) transition to medical clinical trials of possible drug interventions. This project will provide a more thorough understanding of the basic vestibular, neurophysiologic and behavioral affects of motion and simulated environments. The results of this study will have applications to other military and

civilian modes of transportation and simulation, and will yield a better understanding of certain aspects of the Space Adaptation Syndrome.

Navy Medicine is Part of a Joint Project to Develop Combined Oral Vaccines against Infectious Diarrheal Diseases

Prevention of infectious illnesses through improved vaccines is an important component of military medicine. Navy and Army researchers have targeted diarrheal agents for combined vaccine development because, in terms of morbidity and lost duty time, diarrheal diseases pose the greatest threat to deployed US forces during regional conflicts. To achieve a reasonable level of protection it will be necessary to immunize against the three to five most prevalent diarrheal agents. This could be accomplished with a combined vaccine. Combining several vaccines into a single formulation to protect against different diseases has been widely used in clinical practice for many years (i.e., diphtheria-tetanus-pertussis and measles-mumps-rubella vaccines). A joint two-year project between the Naval Medical Research Institute, Bethesda, MD and the Walter Reed Army Institute of Research, Washington, DC is underway to develop and evaluate oral, multi-agent anti-diarrheal vaccines. The project capitalizes on the Navy's and Army's existing expertise in vaccine research and their recent advances in the development of mucosal adjuvants, time-released microencapsulation techniques, and bacterial attenuation. This study will compare two prototypes: (1) an oral adjuvanted trivalent killed whole cell vaccine against *Shigella*, enterotoxigenic *E. coli* (ETEC), and *Campylobacter*, and (2) a novel vaccine comprised of live attenuated *Shigella flexneri* administered with time-released microencapsulated ETEC colonization factor antigen II (CFA-II). The results of this pre-clinical study will be critical in Investigational New Drug Applications for Phase I-II trials of any similar vaccines moving into advanced development and human clinical studies.

Navy Medical Research Unit in Jakarta, Indonesia Receives WHO Recognition

The Naval Medical Research Unit No. 2 (NAMRU-2), a DoD infectious disease laboratory, has been designated by the World Health Organization (WHO) as a Regional Collaborating Center for New, Emerging and Reemerging Diseases in Southeast Asia. WHO leads the international focus on the significant threat posed by an increase in infectious diseases around the world and is actively involved in improving disease surveillance. This designation means NAMRU-2 will become a clearing house for infectious diseases information in Southeast Asia, provide reference laboratory services, assist in disease outbreak investigations and provide training for other nations in the region. NAMRU-2's primary mission is to support operational commanders through research on infectious and preventive medicine guidance, a mission it has carried out with excellence in Asia since 1942. Current research efforts focus on malaria, cholera, typhoid fever, HIV, dengue fever, severe diarrhea, viral hepatitis, and Japanese encephalitis. In addition to regular research activities, NAMRU-2 is a World Health Organization (WHO) Regional Collaborating Center for New, Emerging and Reemerging Diseases in Southeast Asia. WHO leads the international focus on the significant threat posed by an increase

in infectious diseases around the world and is actively involved in improving disease surveillance. This designation means NAMRU-2 will become a clearing house for infectious diseases information in Southeast Asia, provide reference l

**Navy Receives Patent for
Experimental Biochemical
Decompression Method for Divers**

Decompression is a dangerous and time-consuming phase of any military diving mission. The current method of decompression, utilizing the Navy Diving Tables, is carefully controlled rates of ascent. The rates of ascent are selected based on past history of ascent rates with minimal incidence of decompression sickness (DCS). A new method to shorten decompression would reduce a time of great personal risk to the diver as well as reduce expenses of the dive operation. A new patent was recently issued to two researchers at the Naval Medical Research Institute, Bethesda, MD, for developing a biochemical method to accelerate gas removal from diver's tissues utilizing gas metabolizing bacteria. Biochemical decompression is a novel approach to eliminating the inert gas in a diver's body using non-toxic bacteria introduced to the intestinal tract to chemically eliminate the gas from a diver's tissues with no serious side, toxic or immunological effects. This new method is designed for divers using a breathing mixture of oxygen and nitrogen or hydrogen. The metabolism of the hydrogen or nitrogen causes a reduction of the partial pressure of the metabolized gas in the large intestine and increases the diffusion of the metabolized gas from the blood and surrounding tissue into the intestine. The development of this work into an FDA approved product for human use trials is the next step for the researchers. Human trials are expected in five to seven years.

**Navy Researchers Make Organ
Transplant Breakthrough**

Navy medical researchers believe they have found a way to prevent "mismatched" transplanted organs from being rejected, thanks to a new therapy that re-educates the immune system. CAPT David M. Harlan and LCDR Allan D. Kirk, from the Navy Medical Research Institute, Bethesda, MD, and other Navy researchers have developed a new medical therapy that re-educates the immune system to recognize transplanted organs -- even transplanted organs that are completely mismatched -- as being the individual's own. This "acceptance" of the organ prevents it from being rejected. The investigators reached a significant milestone in their research when they transplanted very mismatched kidneys into two monkeys and treated them with the therapy. No other therapy, including the use of anti-rejection drugs, was administered. Six months later, the monkeys are robust and suffering virtually no side effects. The expected life span for monkeys with mis-matched kidneys is about 21 days. A summary of Dr. Harlan and Dr. Kirk's research is published in the August 5 issue of the Proceedings of the National Academy of Science.

**Research Model Streamlines
Forward Medical Supplies for the
Marine Corps**

Recent organizational changes in the medical battalion structure led the Commandant of the Marine Corps to request a review of the current Authorized Medical Allowance Lists (AMALs) for the Marine Corps' far forward medical treatment facilities. Working closely with Marine Corps medical professionals including the 1st, 2nd, and 4th Medical Battalions, the 1st and 2nd Force Service Support Groups, and the Naval Hospitals at Camp Pendleton and Camp Lejeune, researchers at the Naval Health Research Center, San Diego, CA, reviewed treatment briefs, tasks, and supplies and equipment lists. The result of this work is a computer model of Echelon I and II (Battlefield, Battalion Aid Station and Surgical Company) supply streams that establishes a clinical requirement for each item used to support forward medical care. Each clinical requirement is linked to the injuries and diseases known to occur in theater. The researchers first applied the model to laboratory and X-ray supplies and equipment. The study showed that reductions could be made. For example, 39 items in the proposed laboratory equipment AMAL could be eliminated with a corresponding 33% reduction in weight and a 16% reduction in space. Savings in the weight (55%) and cube (71%) of the laboratory consumable AMAL also were realized, while increasing the number of diagnostic tests. Reductions were also realized for the two X-ray AMALs. A net weight savings of 19% and space savings of 8.5% were realized for the proposed equipment AMAL, while a savings of 8% in space and 12% in weight for the X-ray consumables were realized. Through the process of establishing the clinical requirement for each supply item, an audit trail was produced giving logisticians and medical planners an objective management tool for maintaining and upgrading medical materiel. To ensure tri-service unity, the computer model's databases are compatible with the DEPMEDS (Deployable Medical Systems) databases.

**Navy Researchers Receive the
Inaugural Berry Prize in Federal
Medicine**

CAPT David M. Harlan, MC, USN, and CAPT Carl June, MC, USN (Ret.) received the Frank Brown Berry Prize for 1997 for their important advances in T-cell manipulation resulting from research at the Naval Medical Research Institute (NMRI), Bethesda, MD. In 1987, while researching new strategies for the treatment of combat injuries. Dr. June and other Navy researchers observed that the engagement of T lymphocytes requires activation of a specific surface receptor on the T-cell called CD28. Over the last decade, Dr. June and Dr. Harlan demonstrated that blocking CD28 activation with antibodies and bioengineered molecules prevented T lymphocytes from reacting to foreign protein (or antigen) and rendered them permanently unresponsive (or anergic). This therapy, called anergy therapy, offers a multitude of possibilities for the treatment of combat casualties. Besides the implications for military medicine, anergy therapy has the potential of treating a broad spectrum of medical conditions such as rheumatoid arthritis, insulin dependent diabetes and systemic lupus erythematosus. The Frank Brown Berry Prize was initiated this year by U.S. Medicine, an independent national newspaper for physicians, with co-sponsorship by Science Applications International Corporation of La Jolla, CA.

Researchers Designing a Diver-Worn Sound Meter

Navy divers are exposed to a variety of sounds in diverse settings ranging from ship's husbandry to special warfare operations in littoral environments. A difficulty in protecting divers in these circumstances is the lack of adequate underwater sound monitoring equipment. There is no underwater equivalent to the hazardous noise assessment tools operated by industrial hygienists on the surface. Currently, divers have no means for detecting, identifying, avoiding, or protecting themselves from sounds that can compromise their health and safety. In a joint three-year project between the Naval Submarine Medical Research Laboratory, Groton, CT, and the Naval Medical Research Institute, Bethesda, MD, researchers are developing a prototype diver-worn sound meter capable of detecting and analyzing sound over a broad range of frequencies. Incremental prototype designs will first focus on sound detection, then add dosimetry, and finally add threat detection capabilities. Each device will undergo laboratory testing for accuracy and durability as well as field testing to measure functionality when used by a diver. NSMRL brings expertise in understanding underwater human performance including biomedical effects of sound on divers and the laboratory has available on-site a working harbor with a sizable dive locker. NMRI brings expertise in electronics and packaging of instrumentation backed by years of diving research.

Navy Researchers Testing Oral Vaccine Against Travelers' Diarrhea

Campylobacter is a leading cause of travelers' diarrhea and a serious threat to deployed military forces. For example, the reported diarrhea attack rates for US military personnel during exercises in Thailand have consistently approached 50%. Of these, up to 60% have been due to Campylobacter infection, and more than three-quarters of the isolates are resistant to commonly used antibiotics. Although most Campylobacter episodes are moderate and self-limited, about one-third are incapacitating. Campylobacter causes at least 2 million clinical cases of diarrhea per year in the US, and there are over 400 million individuals worldwide who suffer from the disease each year. Recognizing this threat, researchers at the Naval Medical Research Institute, Bethesda, MD, collaborating with the U.S. Army Medical Research Institute of Infectious Diseases, Ft. Detrick, MD, and industrial partners Antex Biologics, Gaithersburg, MD and SmithKline Beecham Biologicals, have developed an oral Campylobacter vaccine. The vaccine is composed of C. jejuni bacteria that have been formalin-inactivated, and is administered with a new oral adjuvant. Phase I studies showed that the vaccine was safe and immunogenic. These landmark studies were the first successful clinical evaluation of the oral vaccine, and the first to show immune enhancing activity. Phase II trials are now underway. An easily administered Campylobacter vaccine for forward deployed military personnel will have a positive impact on military readiness and mission performance.

**Adenovirus Epidemics: Navy
Researchers Leading Triservice
Surveillance Effort**

There are over 40 different adenoviruses, found in all parts of the world, which cause a variety of respiratory diseases, including the common cold. Before the routine administration of adenovirus vaccines to military recruits in the 1960s, 10% of recruits became infected and 90% of this group developed pneumonia. For nearly 30 years, adenovirus vaccines have reduced acute respiratory disease (ARD) morbidity among recruit populations. However, the sole manufacturer of the vaccines ceased production and epidemics of adenovirus infections are imminent among recruit populations. These epidemics will severely impact military training and may overwhelm military treatment facilities. DoD is actively seeking a way to resume production before current vaccine supplies are depleted by the spring of 1998. In the meantime, Navy scientists at the Naval Health Research Center (NHRC) in San Diego, CA, and collaborators from eight other Army, Navy, and Air Force commands are conducting clinical epidemiological studies to determine the prevalence and distribution of adenovirus serotypes among military trainee populations. Five training sites are the focus of these studies: Marine Corps Recruit Depot, San Diego, CA; Naval Recruit Training Center, Great Lakes, IL; Fort Leonard Wood, Waynesville, MO; Fort Jackson, Columbia, SC; and Lackland Air Force Base, Lackland, TX. Preliminary results suggest that the adenoviral vaccines are effective in controlling the targeted serotypes but unusual serotypes of adenovirus are also causing respiratory diseases. The results are important in determining prevention strategies and defining vaccine development priorities.

**Navy Received Patent for a self-
contained Personal Microwave
and Radio Frequency Detector
Worn in the Ear**

Currently microwave and radio frequency (RF) risks to personnel in the work area (i.e., hospital locations, flight lines, air craft carriers, etc.) are detected by surveying an area with hand-carried instruments or instruments fastened to clothing to determine if the area exceeds permissible exposure limits. While current detectors are effective, Navy researchers recognized a need for a microwave and RF detector which would provide an instantaneous, audible warning of high electromagnetic fields, and still permit workers to perform their normal tasks while wearing protective equipment such as helmets, goggles, ear muffs, etc. The researchers, who began their work at the Naval Aerospace Medical Research Laboratory, Pensacola, FL, and continued at the Naval Medical Research Institute Detachment (Brooks), San Antonio, TX, received a US patent for inventing a simple, compact, self-contained detector that covers an extremely broad band of frequencies (2mhz to 22ghz) which produces an audible sound when the wearer is at risk. The detector, worn in the ear canal, allows a user to perform normal duties while being warned of transmitting devices operating in the vicinity or of high levels of beamed, reflected or irradiated energy that might unintentionally occur in a workplace.

Long-Term follow-up of Health and Readiness Shows Sailors Staying Fit

In 1982, the Navy established a comprehensive Health and Physical Readiness Program to promote health and physical fitness, set minimum standards for fitness and weight control, and emphasize the need for all active-duty personnel to participate in life-style behaviors that promote good health. Researchers at the Naval Health Research Center (NHRC), San Diego, were instrumental in establishing the Navy's physical readiness standards, developing the methods and equations for assessing body fat, and initiating a comprehensive program to evaluate health promotion interventions, such as smoking cessation, alcohol rehabilitation, and weight control. In a recent NHRC study to evaluate trends in health behaviors and physical readiness, researchers conducted a follow-up survey of over 5,500 Navy personnel who had participated in the earlier NHRC studies in the 1980s. Overall, the researchers found that career Navy people were (1) maintaining a vigorous level of physical activity, (2) eating a significantly more healthful diet, (3) exhibiting markedly greater muscle mass, (4) sustaining body fat levels that remained within the Navy's established limits, and (5) demonstrating significantly improved physical fitness scores despite being older. The study participants represent the career naval force who are somewhat older, higher-ranked, service-committed personnel who exemplify a new level of physical readiness and serve as models for more junior members of the fleet.

Researchers Use Cutting Edge Technology to Help Develop New Marine Combat Boot

One of the biomechanical risk factors for musculoskeletal injury is impact shock generated by repeated impact between the foot and the ground that is transmitted through the musculoskeletal tissues of the lower limb and spine. As part of an on-going program to reduce musculoskeletal injuries in training populations, researchers at the Naval Health Research Center, San Diego, were asked by the Marine Corps to be part of a team to evaluate the biomechanical aspects of current commercially available boots and government issued boots and to provide recommendations for an improved design. The research team tested existing Marine Corps leather and jungle boots for baseline performance characteristics and compared them with commercially available boots. The biomechanical measurements covered two categories: (1) physical tests aimed at mechanically characterizing the entire boot and the boot's component materials, and (2) human testing to quantify various physical properties and the body's response. Specific emphasis was placed on shock absorption, energy return, and stability. The new boot design developed from these tests has a rubber outsole for durability and a polyurethane midsole and insole for cushioning. In addition to the increased cushioning of the sole, there is increased cushioning throughout the boot with a semi-wedged midsole/outsole for better traction and ground contact. Other features include a softer, more flexible waterproof leather. Another important feature is the revised lacing system that extends further down the toe to maximize foot fit and function. The final specifications for the new boot were derived from focus groups and wear tests with Marine Corps Infantry and Fleet Marine Force personnel. The new boot is an excellent example of how Navy medical researchers work hand-in-hand with operational forces.

